

COVID 19 AND NUTRITION : CORONAVIRUS AND 5 IMMUNE BOOSTING NUTRIENTS

JULIUS OBEN¹ & JEANNE NGOGANG¹

¹Cameroon Academy of Sciences

*Correspondence : juliusoben@hotmail.com & jngogang@yahoo.fr

Abstract

The COVID-19 outbreak which started in 2019 in China, turned out to be a deadly, infectious worldwide pandemic, caused by the SARS-CoV-2. COVID-19 affects the respiratory system, symptoms including cough, fever and shortness of breath. Upon infection, there is an uncontrolled release of pro-inflammatory cytokines, leading to acute respiratory distress syndrome, and even death. The shutdown of economies during the outbreak made acquisition of nutritious foods difficult, exposing the world to malnutrition. This was worse in underdeveloped countries where there is poor hygiene and poor healthcare systems. A good and balanced nutrition strengthens the immune system, with fruits and vegetables enhancing the anti-inflammatory responses and regulating chronic diseases which are risk factors for COVID-19. In Cameroon, decoctions against COVID-19 made from medicinal plants and foods were widely used. This included 'star yellow', a sauce formulated and used for its role in the control of the transmission of SARSCOV-2. Star yellow contains a combination of palm oil and limestone, which exposes viral RNA to zinc attacks. It also possesses anti-viral and antioxidant properties which inactivates the viral particles in the gut thus stopping the possible transmission of the SARSCOV-2 virus via faeces.

Keywords: COVID-19, Nutrition

Résumé

L'épidémie à COVID-19 qui a fait son apparition en 2019 en Chine, s'est révélée être une pandémie mondiale infectieuse et mortelle, causée par le SRAS-CoV-2. Le COVID-19 affecte le système respiratoire et les symptômes comprenant la toux, la fièvre et l'essoufflement. Lors de l'infection, il y a une libération incontrôlée de cytokines pro-inflammatoires entraînant un syndrome de détresse respiratoire aiguë voire la mort. L'arrêt des économies pendant l'épidémie a rendu difficile l'acquisition d'aliments nutritifs, exposant le monde à la malnutrition. Cette situation a été aggravée dans les pays sous-développés où l'hygiène et les systèmes de santé sont défaillants. Une alimentation de bonne qualité et équilibrée renforce le système immunitaire notamment avec les fruits et les légumes qui renforcent les réponses anti-inflammatoires et régulent les maladies chroniques, facteurs de risque du COVID-19. Au Cameroun, plusieurs décoctions à base de plantes médicinales et d'aliments étaient largement utilisées pour lutter contre le COVID-19 parmi lesquelles, la " star yellow ", une sauce formulée et utilisée de par son rôle dans le contrôle de la transmission du SRASCOV-2. La sauce " star yellow " faite à base d'huile de palme et de sel gemme expose l'ARN viral aux attaques du zinc. Elle possède également des propriétés antivirale et antioxydante qui inactivent les particules virales dans l'intestin, empêchant ainsi la transmission éventuelle du virus du SRASCOV-2 par les selles.

Mots clés : COVID-19, Nutrition

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Background

In December 2019, there was an outbreak of pneumonia of unknown cause in Wuhan, Hubei Province, China, which affected more than 60 people on the twentieth of that month. On 31 December, the Wuhan Municipal Health Committee informed the World Health Organization (WHO) that 27 people had been diagnosed with pneumonia of unknown cause, being 7 of them critically ill (ISIDP, 2020). By January, the first cases of coronavirus disease 2019 (COVID-19) had been reported outside China: two in Thailand and one in Japan. Then, the rapid spread of the disease prompted the WHO to declare it as a health emergency of international concern, based on the impact the virus could have on underdeveloped countries with fewer health infrastructure. By that date, the disease had been detected in all provinces of mainland China, and cases were also diagnosed in 15 other countries. In March, the disease was already in more than 100 territories worldwide, and recognized as a pandemic by the WHO. At present, the number of confirmed cases continues to grow (Fernández-Quintela et al., 2020). The COVID-19 pandemic is among the deadliest infectious diseases to have emerged in recent history. This emerging threat posed has strongly modified the lifestyles, making urgent to reconsider the humans-environment, relationships and stimulating towards more sustainable choices in daily behavior. Therefore, the best way to prevent transmissible infections still is to practice self-sanitation, social distance, and enhance immunity against targeted viruses (Marchi et al., 2021).

COVID 19 transmission and symptoms

The virus that produced COVID-19 is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), an enveloped positive-sense RNA virus that mainly affects the respiratory system, being the spread of droplets generated by an infected subject the main route of transmission. It has been noted that the presence of other chronic diseases in the patient may exacerbate the inflammatory response derived from COVID-19, increasing the risk for adverse effects and mortality

(Fernández-Quintela et al., 2020). The presence of COVID-19 is manifested by several symptoms, ranging from asymptomatic/mild symptoms to severe illness and death. Common symptoms include cough, fever, and shortness of breath. Other reported symptoms are weakness, malaise, respiratory distress, muscle pain, sore throat, loss of taste and/or smell (Lovato et al., 2019; Esakandari et al., 2020).

Pathogenesis

The pathogenesis of COVID-19 is not yet fully understood (Farzana et al., 2022). After infection with SARS-CoV-2, it binds to angiotensin-converting enzyme 2 (ACE2) receptors to enter lung cells, and then the virus targets ACE2+ type II alveolar cells in the lungs (García, 2020). Infected lung cells secrete the cytokine IL-8, which attracts T cells and neutrophils (Groeneveld, 2002). In addition, activation of transcription factors such as nuclear factor κ B (NF- κ B) and activator protein 1 (AP-1) leads to the release of pro-inflammatory cytokines such as IL-6, TNF- α , and interferon-1 (Farzana et al., 2022). Due to the secretion of various chemokines, innate immune cells accumulate in the infection zone, which releases even more chemokines and recruits lymphocytes. This leads to an uncontrollable release of pro-inflammatory cytokines, resulting in multiple complications such as acute respiratory distress syndrome (ARDS) and organ failure, which can progress to death (Farzana et al., 2022).

Impact of the pandemic

The COVID-19 pandemic as a health and human crisis, has threatened the food security and nutrition of millions of people around the world. Before the virus hit, hundreds of millions of people were already suffering from hunger and malnutrition and, without immediate action taken, a global food emergency was planned. In the longer term, the combined effects of COVID-19 itself, as well as corresponding mitigation measures and the emerging global recession could, without large-scale coordinated action, disrupt the functioning of food systems. Such disruption can result in consequences for health and nutrition of a severity and scale unseen for

more than half a century. Several implications of COVID in food insecurity have been identified: i) countries diverted their limited resources to meet immediate medical needs; ii) the closure of economies disrupted supply chains and the contraction of informal economies usurped purchasing power; iii) as a result, nutritious food and basic health services are becoming increasingly difficult to obtain (International Nutrition, 2022). Together, these factors bring the world to the brink of a malnutrition crisis, one that has the potential to be even more devastating than COVID-19. In 2022, millions of people live in poverty, particularly in Africa and Asia. They live in crowded conditions where hand washing and physical distancing are challenges. Moreover, they already have weakened immune systems or underlying diseases, often caused by malnutrition (International Nutrition, 2022). In addition to this, the state of self-isolation and social distancing has had serious repercussions on people's lives, leading to changes in eating, sleeping and physical activity patterns. This has promoted sedentary behaviours affecting mental and physical health and leading to an increased risk of obesity (Gleeson et al., 2004).

The role of nutrition in the management of COVID 19

Optimal nutrition is one of the main determinants of health that can improve well-being and mitigate the harmful health consequences associated with social distancing by helping to prevent or control most chronic diseases (eg diabetes, hypertension, and excess body weight/obesity); aid in the regulation of sleep and mood; and prevent fatigue (Flaskerud, 2015). Nutrient intake and disease incidence generally influence nutritional status, especially in developing countries where everyone aspires to eat well (Bogoch et al., 2020). Nutritional status is therefore an important factor in maintaining a strong immune system against COVID-19 by modulating gene expression, activating cells and modification of signalling molecules. Various food ingredients are determinants of the microbial composition of the gut and subsequently shape immune responses in the body (Aslam et al., 2017). Some nutrients, such as omega-3 polyunsaturated fatty acids and

probiotics, have been linked to anti-inflammatory responses and enhanced resistance to upper respiratory tract infection (Weyh et al., 2020; Zabetakis et al., 2020). Nearly 70% of the documents retrieved encouraged the consumption of fruits, vegetables, and whole grain foods. Diets rich in fruits and vegetables contain high amounts of vitamins and minerals, including vitamins A, C, D, E, and B complex, as well as zinc and selenium, which are important modulators of the immune system (Maggini et al., 2018). In addition, fruit and vegetables are good sources of water, antioxidants, and fiber, all of which play a role in the control of hypertension, diabetes, and weight gain, some of the most important risk factors for COVID-19 complications. Micronutrients contribute to immune function through a variety of pathways in both innate and adaptive immune responses. Vitamins A, C, D, E, B6, and B12 and zinc are important for the maintenance of structural and functional integrity of physical barriers (eg, skin, gastrointestinal lining, respiratory tract, and others) as well as for the differentiation, proliferation, function, and migration of innate immune cells (Khayatzadeh, 2020; Gombart et al., 2020). Meanwhile, vitamins C and E, along with zinc and selenium, protect against free radical damage during increased oxidative stress. Vitamins A, C, D, E, B6, and B12 and zinc and selenium support the adaptive immune response by influencing the differentiation, proliferation, and normal function of T and B cells. These nutrients also affect antibody production and function and contribute to cell-mediated immunity, and support the recognition and destruction of pathogens. Lastly, they have antimicrobial activity and regulate the inflammatory response (Calder, 2013; Gombart et al., 2020).

Almost, one-third of the organizations and societies recommended avoiding the intake of salt, fat, and sugar and encouraged reductions in sugary drinks, other sugar-rich products, meat portions, and other foods of animal origin to lower the intake of saturated fat (WHO, 2020; Khayatzadeh, 2020). Actually, diets high in sodium (including salt) increase the risk of high blood pressure, which lead to heart

disease and stroke. Preventing these conditions related to cardiovascular diseases can help reducing the severity of illness from COVID-19. WHO recommends consuming less than 5 g of salt per day (i.e. less than 2 g of sodium per day) for adults. For children, this recommended level should be reduced based on their lower energy requirements. It is also known that diets high in sugars have a greater risk of causing overweight or obesity, diabetes, heart disease and stroke, as well as an increased risk of tooth decay. People with pre-existing medical conditions (e.g. heart disease and diabetes) appear to be more vulnerable to becoming severely ill with COVID-19. WHO recommends reducing the intake of free sugars to less than 10% of total energy intake and suggests a further reduction of the intake of free sugars to below 5% of total energy intake for additional health benefits (WHO, 2020).

Cameroon: the different food and herb formulation for COVID 19 management

Numerous solutions and decoctions based on medicinal plants and local foods have emerged since the beginning of the health crisis in March 2020 in Cameroon. Products such as Adsak Covid/Elixir Covid, Corocur, Palubek's, Soudicov qualified as adjuvants by the Ministry of Public Health have appeared. These adjuvants have been independently recognised by a national drug commission in collaboration with the Ministry of Research and the Ministry of Higher Education. In terms of nutrition, an improved yellow sauce called "Star Yellow" has been developed by a group of researchers. It has been stated that "Star Yellow" could be a potential agent in the control of SARS-CoV-2 virus transmission (Oben et al., 2020).

***Star yellow**

The Cameroonian cuisine is extremely rich in variety and content, with many traditional dishes known for their functional potential. One such dish is 'yellow soup' which is widely eaten in the grass field regions of the country, and is now an exotic dish in the major cities (Yaoundé and Douala) where persons go to specific restaurants just for this delicacy, and is well sought out for at receptions (Oben et al., 2020). "STAR YELLOW" is derived from this yellow soup with main ingredients to which

were added spices with known antiviral and antioxidant activities (Oben et al., 2020).

Consumption of 'Star Yellow' delivers its functional components directly into the gastrointestinal tract which could be a reservoir for live virus in COVID-19 patients (Wang et al., 2020). The functional components in 'Star Yellow' have been shown to possess anti-viral and antioxidant properties. *C. manni* and beef stock provide zinc which is a potent inhibitor to RNA replication in viruses. The combination of palm oil and limestone represents a reaction of a metallic alkali (base) with fat, generally referred to as saponification. The resulting product has the potential to break down the viral envelope exposing its RNA to zinc, which inhibits replication by blocking a key viral enzyme utilized for replication in host cells, RNA polymerase (te Velthuis et al., 2010). The chemical structure of *D. glomerata* has aromatic rings similar to that in the chloroquine molecule with the benzothioephine derivative pyriothione possibly forming zinc ionophores which alter the permeability of the viral envelope, thus enhancing zinc transport (Xue et al., 2014). The fact that Star Yellow combines these various ingredients will possibly help in breaking down the envelope of the SARS-CoV-2 present in the gastrointestinal tract of infected persons, exposing it to the zinc present. The feces as well as the resulting fecal bioaerosols will therefore contain only inactive viral particles, thereby stopping transmission by feces (Oben et al., 2020).

Conclusion

People around the world are making responsible effort to reduce virus transmission and preserve human health during COVID 19 pandemic. Nutrition plays a key role in the overall health, as well as recovery from illnesses. Optimal intake of all nutrients, mainly those that play crucial roles in immune system, should be assured through a diverse and well-balanced diet. However, current data suggest that there is a prevalent micronutrient and omega-3 fatty acid deficiency in several population groups. In order to promote the optimum functioning of the immune system and to reduce the risk and consequences of

infections, the intakes for some micronutrients may exceed the recommended dietary allowances since infections and other stressors can reduce micronutrient status.

References

- Esakandari H, Nabi-Afjadi M, Fakkari-Afjadi J, Farahmandian N, Miresmaeili SM, Bahreini E. A comprehensive review of COVID-19 characteristics. *Biol Proced Online*. 2020 Aug 4;22:19. doi: 10.1186/s12575-020-00128-2. PMID: 32774178; PMCID: PMC7402395.
- Xue J, Moyer A, Peng B, Wu J, Hannafon, BN, Ding W-Q (2014). Chloroquin is a zinc ionophore. *Plus One* 9(10):e109180.
- te Velthuis AJ, van den Worm SH, Sims AC, Baric RS, Snijder EJ, van Hemert MJ. Zn(2+) inhibits coronavirus and arterivirus RNA polymerase activity in vitro and zinc ionophores block the replication of these viruses in cell culture. *PLoS Pathog*. 2010 Nov 4;6(11):e1001176. doi: 10.1371/journal.ppat.1001176.
- Farzana M, Shahriar S, Jeba R, Tabassum T, Araf Y, Ullah A, Tasnim J, Chakraborty A, Naima A, Marma K, Rahaman I and Hosen J. Functional food: complementary to fight against COVID-19. *Beni-Suef University Journal of Basic and Applied Sciences*. 2022. 11(33) : 1 – 18.
- Fernández-Quintela A, Milton-Laskibar I, Trepiana J, Gómez-Zorita S, Kajarabille N, Léniz A, González M, Portillo MP. Key Aspects in Nutritional Management of COVID-19 Patients. *J Clin Med*. 2020 Aug 10;9(8):2589. doi: 10.3390/jcm9082589. PMID: 32785121; PMCID: PMC7463687.
- Flaskerud JH. Mood and food. *Issues Ment Health Nurs*. 2015;36:307–310.
- García, Immune response, inflammation, and the clinical spectrum of COVID-19. *Front Immunol*. 2020. 6:66.
- Gombart AF, Pierre A, Maggini S.. A review of micronutrients and the immune system—working in harmony to reduce the risk of infection. *Nutrients*. 2020;12:236.
- Groeneveld A. Vascular pharmacology of acute lung injury and acute respiratory distress syndrome. *Vas Pharmacol*. 2002 39(4–5):247–256.
- International Society for Infectious Diseases ProMed-ISIDP «PRO/AH/EDR» COVID-19 update (59): Global, cruise ship, more countries, WHO. [(accessed on 9 August 2020)];*Int. Soc. Infect. Dis*. 2020 Available online.
- Lovato A, de Filippis C, Marioni G. Upper airway symptoms in coronavirus disease 2019 (COVID-19). *Am J Otolaryngol*. 2020:102474.
- Maggini S, Pierre A, Calder PC.. Immune function and micronutrient requirements change over the life course. *Nutrients*. 2018;10:1531.
- Marchi J, Johansson N, Sarkadi A, Warner G. The Impact of the COVID-19 Pandemic and Societal Infection Control Measures on Children and Adolescents' Mental Health: A Scoping Review. *Front Psychiatry*. 2021 Sep 6;12:711791. doi: 10.3389/fpsy.2021.711791. PMID: 34552516; PMCID: PMC8451953.
- Oben J, Bigoga J, Takuissu G, Teta I and Leke R. The acceptability (Star Yellow), a
- Cameroonian functional food that could curb the spread of the COVID-19 via feces. *Functional Foods in Health and Disease* 2020; (10)8: 324-329 DOI: <https://doi.org/10.31989/ffhd.v10i8.715>.
- Weyh C, Kruger K, Strasser B.. Physical activity and diet shape the immune

system during aging. *Nutrients*. 2020;12:622.

- World Health Organisation-WHO (2020). Healthy diets, the double burden of malnutrition and COVID-19. https://www.who.int/docs/default-source/searo/ncd/dr-chizuru--healthy-diets-the-double-burden-of-malnutrition-and-covid-19.pdf?sfvrsn=c9e82bc7_2.
- Wang W, Xu Y, Gao R, Lu R, Han K, Wu G, Tan W (2020). Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA* doi: 10.1001/jama.2020.